FIG.1

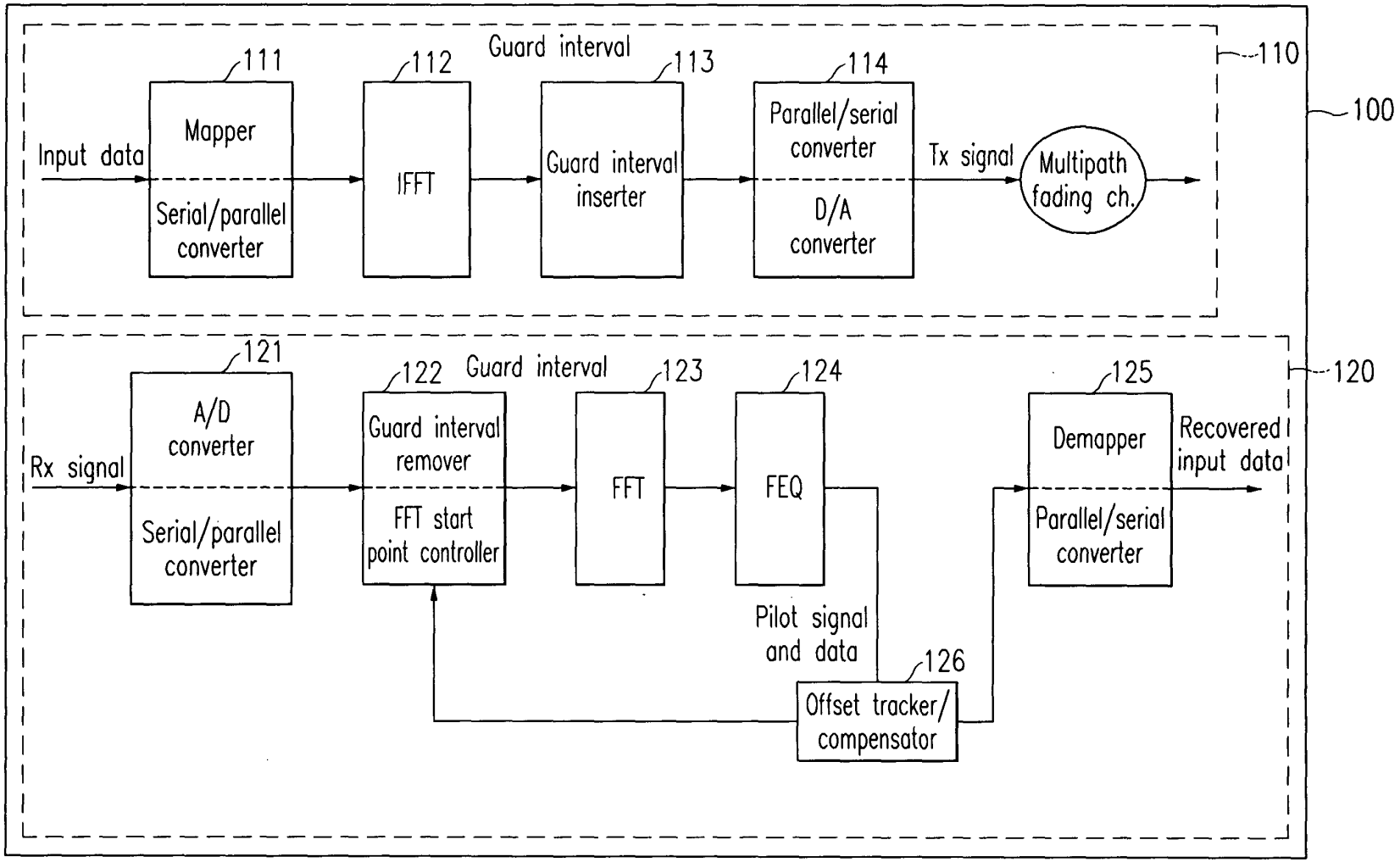

100
110
Guard interval
111
112
113
114
Input data
Mapper
Serial/parallel converter
IFFT
Guard interval inserter
Parallel/serial converter
D/A converter
Tx signal
Multipath fading ch.
120
121
122
Guard interval
123
124
125
Rx signal
A/D converter
Serial/parallel converter
Guard interval remover
FFT start point controller
FFT
FEQ
Demapper
Parallel/serial converter
Recovered input data
Pilot signal and data
126
Offset tracker/ compensator

FIG.2A

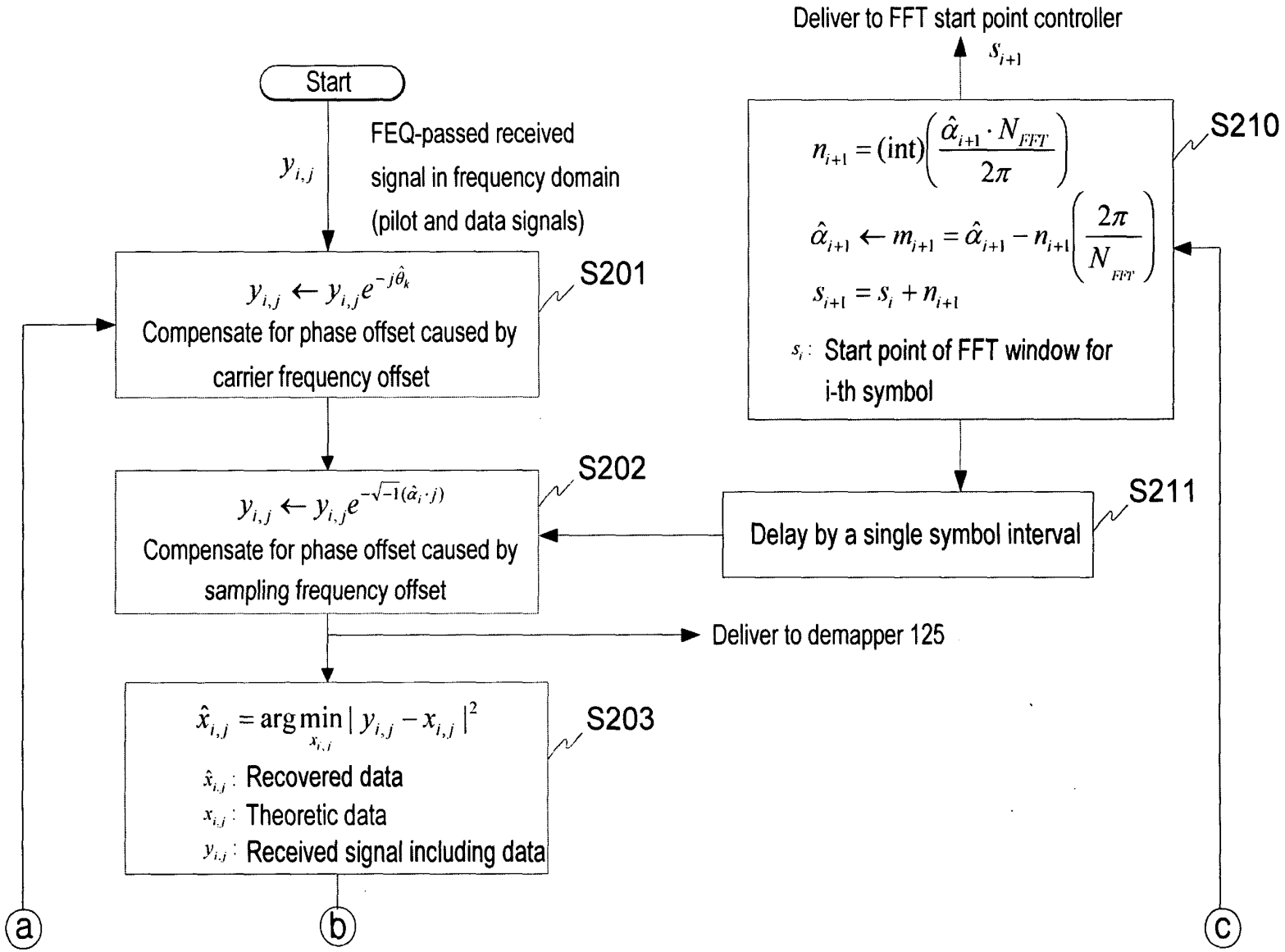
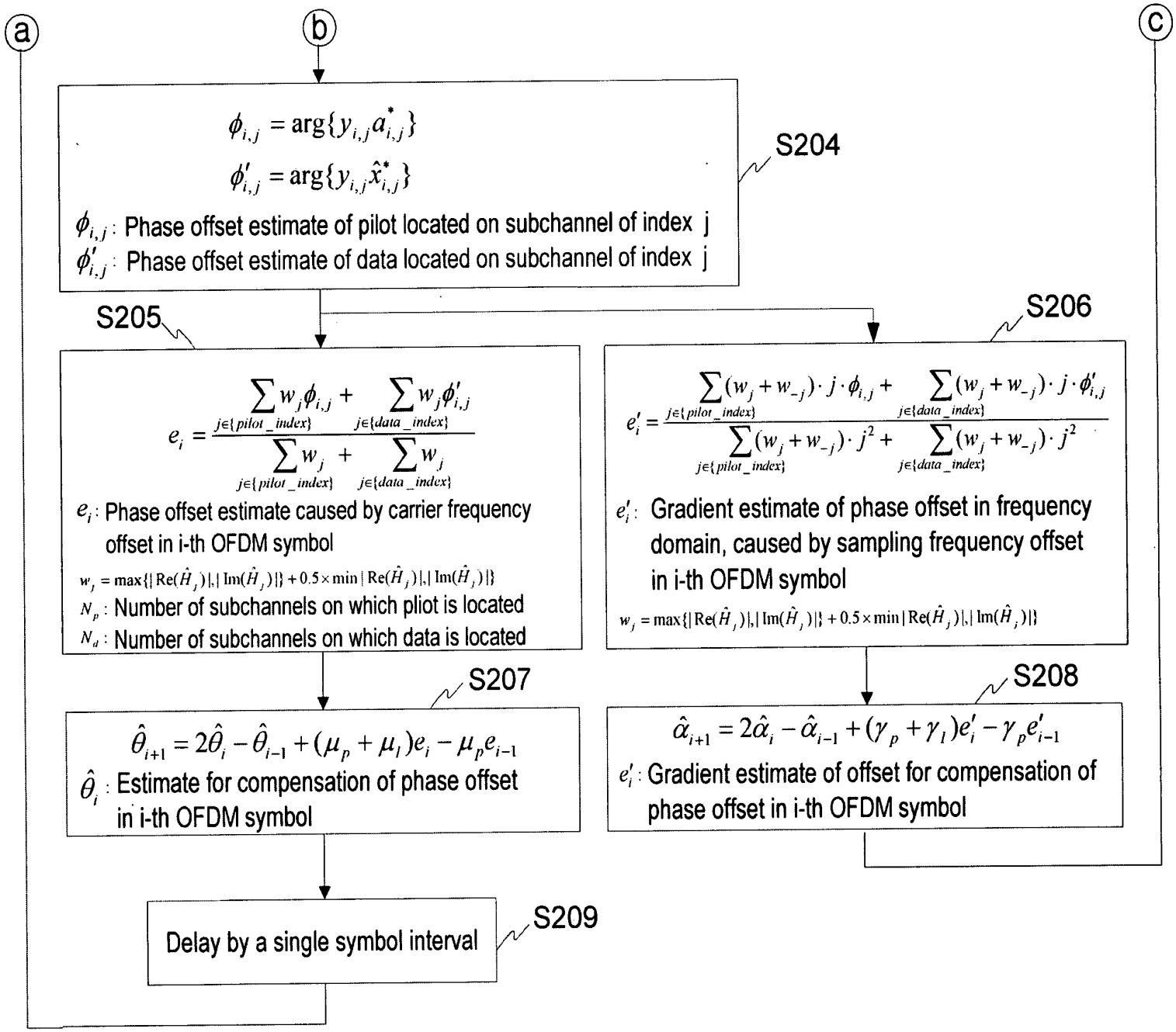

Start
$y_{i,j}$
FEQ-passed received signal in frequency domain (pilot and data signals)
$y_{i,j} \leftarrow y_{i,j} e^{-j\hat{\theta}_k}$
Compensate for phase offset caused by carrier frequency offset
S201
$y_{i,j} \leftarrow y_{i,j} e^{-\sqrt{-1}(\hat{\alpha}_i \cdot j)}$
Compensate for phase offset caused by sampling frequency offset
S202
Deliver to demapper 125
$\hat{x}_{i,j} = \arg\min_{x_{i,j}} | y_{i,j} - x_{i,j} |^2$
$\hat{x}_{i,j}$: Recovered data
$x_{i,j}$: Theoretic data
$y_{i,j}$: Received signal including data
S203
a
b
Deliver to FFT start point controller
s_{i+1}
$n_{i+1} = (\text{int})\left(\frac{\hat{\alpha}_{i+1} \cdot N_{FFT}}{2\pi}\right)$
$\hat{\alpha}_{i+1} \leftarrow m_{i+1} = \hat{\alpha}_{i+1} - n_{i+1}\left(\frac{2\pi}{N_{FFT}}\right)$
$s_{i+1} = s_i + n_{i+1}$
s_i : Start point of FFT window for i-th symbol
S210
Delay by a single symbol interval
S211
c

FIG.2B


a
b
c
$\phi_{i,j} = \arg\{y_{i,j} a^*_{i,j}\}$
$\phi'_{i,j} = \arg\{y_{i,j} \hat{x}^*_{i,j}\}$
$\phi_{i,j}$: Phase offset estimate of pilot located on subchannel of index j
$\phi'_{i,j}$: Phase offset estimate of data located on subchannel of index j
S204
S205
S206
$e_i = \frac{\sum_{j\in\{pilot\_index\}} w_j \phi_{i,j} + \sum_{j\in\{data\_index\}} w_j \phi'_{i,j}}{\sum_{j\in\{pilot\_index\}} w_j + \sum_{j\in\{data\_index\}} w_j}$
e_i : Phase offset estimate caused by carrier frequency offset in i-th OFDM symbol
$w_j = \max\{|\mathrm{Re}(\hat{H}_j)|, |\mathrm{Im}(\hat{H}_j)|\} + 0.5 \times \min|\mathrm{Re}(\hat{H}_j)|, |\mathrm{Im}(\hat{H}_j)|\}$
N_p : Number of subchannels on which pliot is located
N_d : Number of subchannels on which data is located
$e'_i = \frac{\sum_{j\in\{pilot\_index\}} (w_j + w_{-j}) \cdot j \cdot \phi_{i,j} + \sum_{j\in\{data\_index\}} (w_j + w_{-j}) \cdot j \cdot \phi'_{i,j}}{\sum_{j\in\{pilot\_index\}} (w_j + w_{-j}) \cdot j^2 + \sum_{j\in\{data\_index\}} (w_j + w_{-j}) \cdot j^2}$
e'_i : Gradient estimate of phase offset in frequency domain, caused by sampling frequency offset in i-th OFDM symbol
$w_j = \max\{|\mathrm{Re}(\hat{H}_j)|, |\mathrm{Im}(\hat{H}_j)|\} + 0.5 \times \min|\mathrm{Re}(\hat{H}_j)|, |\mathrm{Im}(\hat{H}_j)|\}$
S207
S208
$\hat{\theta}_{i+1} = 2\hat{\theta}_i - \hat{\theta}_{i-1} + (\mu_p + \mu_l) e_i - \mu_p e_{i-1}$
$\hat{\theta}_i$: Estimate for compensation of phase offset in i-th OFDM symbol
$\hat{\alpha}_{i+1} = 2\hat{\alpha}_i - \hat{\alpha}_{i-1} + (\gamma_p + \gamma_l) e'_i - \gamma_p e'_{i-1}$
e'_i : Gradient estimate of offset for compensation of phase offset in i-th OFDM symbol
Delay by a single symbol interval
S209